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(54) Warning device for use with
pressurised gas dispensers

(57) A warning device for use with a pressurised gas dispenser (eg for medicaments) of the kind having a release valve operated by movement of an actuator relative to a container (2) against restoring force, which device is adapted to warn of emptying of the container and comprises a housing 1, a probe or spring 3 mounted in the housing for acting against the container or actuator in use, whereby movement of the housing may be transmitted via the probe or spring to operate the release valve by effecting relative movement between the container and actuator in use, to complete an electrical circuit comprising the probe or spring, a warning light 8 and batteries B₁, B₂ when the force applied via the probe or spring 3 to the container reaches a predetermined value (when almost empty a greater force is required to operate the release valve). The probe may be distinct from the spring but in contact with it. The warning light 8 may be an LED, LCD, ECD (electrochromic display) or a light bulb. Alternatively, the warning signal may be tactile (a spring loaded button) or a chime or buzzer.

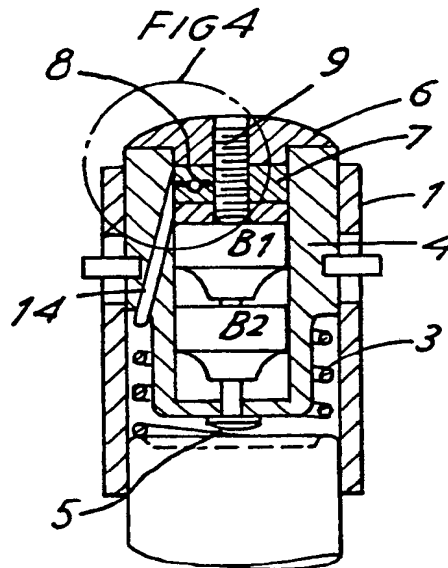


FIG. 2

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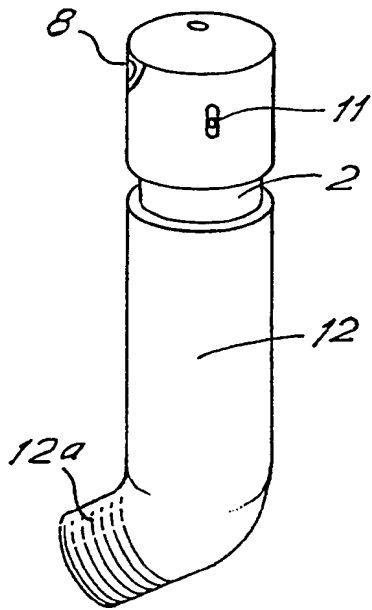


FIG. 1

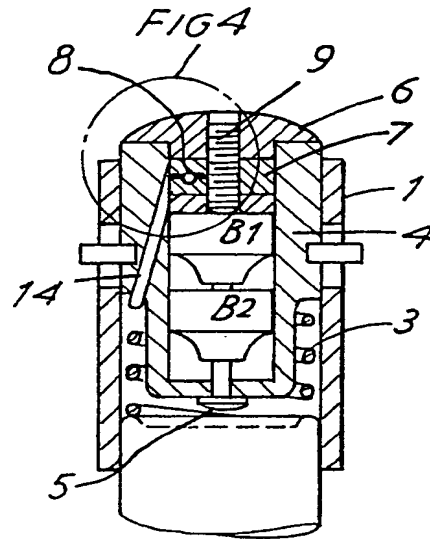


FIG. 2

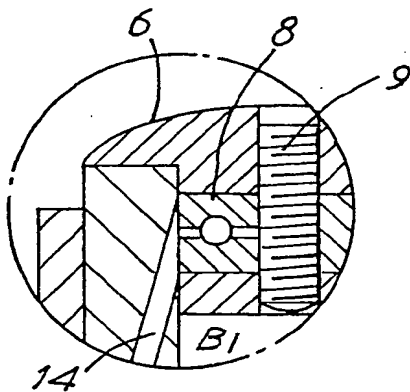


FIG. 4

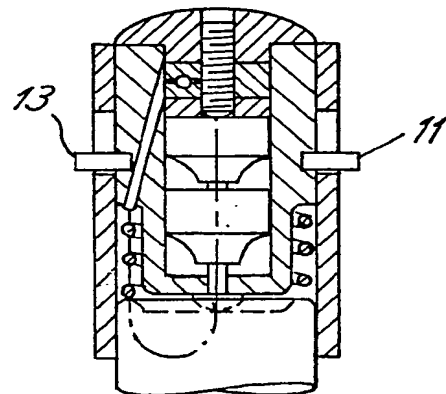


FIG. 3

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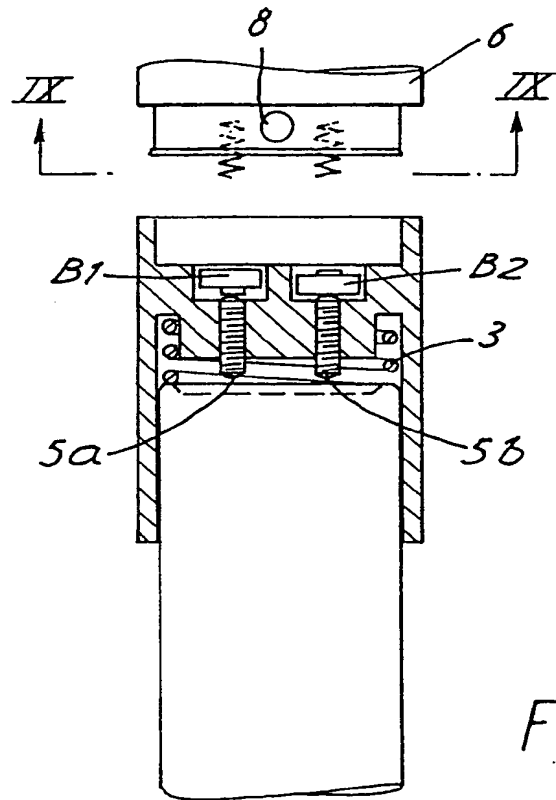


FIG. 8

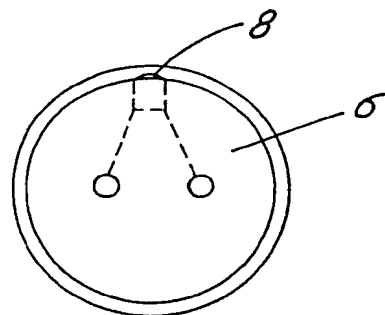


FIG. 9

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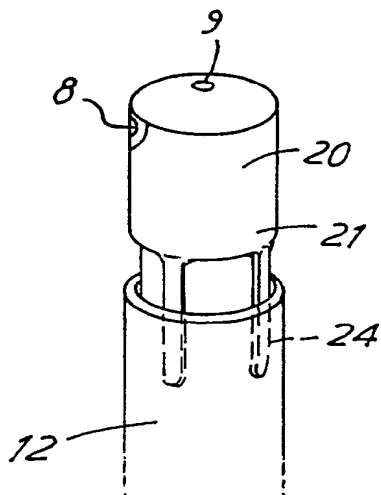


FIG. 5

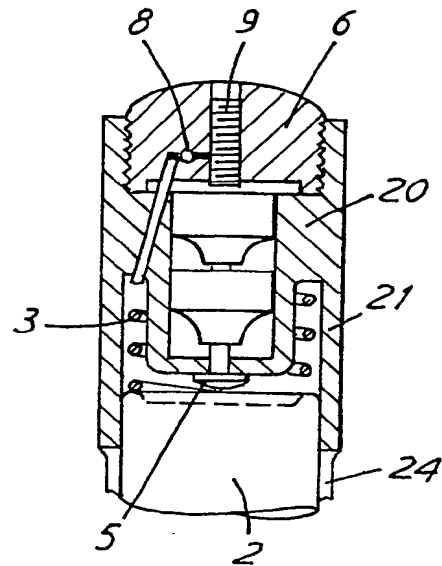


FIG. 6

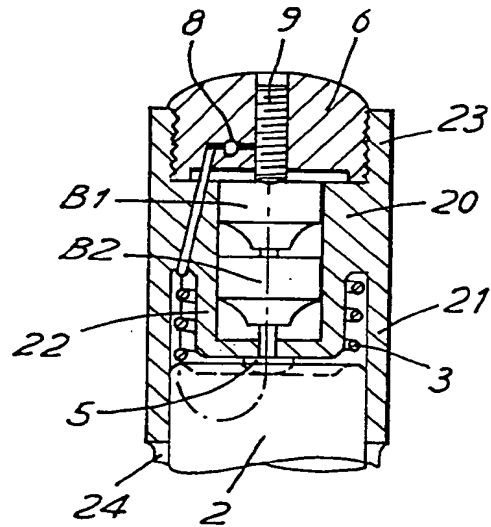


FIG. 7

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SPECIFICATION

Warning device for use with pressurised gas dispensers

5 The present invention relates to a warning device for use in conjunction with pressurised gas dispensers, e.g. aerosol dispensers, of the kind having a container having a release valve
10 operated by movement of an actuator member relative to the container against restoring force.

Aerosol dispensers of this general type are in wide use. All manner of products may be
15 packaged in this way. In particular, certain medicaments intended for inhalation are conventionally supplied in such pressurised aerosol dispensers, the release valve being generally designed to provide a metered dose at
20 each actuation. Usually, such aerosol dispensers are intended to be used in a specially designed inhalation apparatus which typically comprises a receptacle for the pressurised aerosol dispenser into which the dispenser is
25 loaded from above in an inverted condition such that the base of the container of the dispenser protrudes from the receptacle and can be pressed by a user. Extending from the base of the receptacle there is an outlet tube
30 through which the medicament may be inhaled and the release valve actuator member of the pressurised aerosol dispenser abuts against a suitable abutment in the base of the receptacle in fluid communication with the outlet of
35 the inhaler apparatus.

The user of such a medicament may be heavily dependant upon the medicament being rapidly available. A difficulty arises in that the user may be unable to assess quickly whether
40 the pressurised aerosol dispenser is nearly empty or even whether it is wholly empty. There is therefore a need for a warning device which will indicate when the dispenser is about to run out or has run out.

45 Whilst the need for such a device is particularly acute in the case of medicaments, a warning device of the same general kind will also be useful in connection with other products to be dispensed from similar pressurised
50 aerosol dispensers.

The present invention provides a warning device for use in conjunction with a pressurised gas dispenser, e.g. a pressurised aerosol dispenser, of the kind having a container having
55 a release valve operated by movement of an actuator member relative to the container against restoring force which device is adapted to warn of emptying of the container and comprises a housing member, a probe
60 member mounted in the housing member for acting against said container or said actuator member in use, whereby movement of the housing member may be transmitted via said probe member to operate said release valve
65 by effecting relative movement between said

container and said actuator member in use, means for detecting when force applied by said probe member to said container or actuator member reaches a predetermined value,
70 and means for providing a warning signal upon said force reaching said predetermined value.

Preferably such a device comprises said housing, said probe member, which is displaceable for movement towards said housing
75 member, means for producing resilient bias against said displacement which resilient bias increases with displacement, means for detecting when movement of said probe member toward the housing member against said
80 resilient bias reaches a predetermined extent and means for providing a warning signal upon said movement toward the housing member reaching said predetermined extent.

85 Such a device will be useful in connection with pressurised aerosol dispensers or dispensers simply of pressurised gas in which the pressure required to move the actuator member relative to the container sufficiently to open the release valve gradually increases as the pressurised gas in the dispenser is exhausted.

Preferably, the housing member has a mouth portion adapted to fit over the base of a container of an aerosol dispenser.

95 Alternatively however, it is possible for the housing member to have a mouth portion adapted to fit over an actuator member of the release valve of a pressurised gas dispenser.

100 The mouth portion is preferably defined by a preferably generally cylindrical skirt depending from a main body portion of the housing member. The said probe may be provided at the distal end of a spring, e.g. a coil spring,
105 lying within said skirt and serving to provide said resilient bias. For simplicity, the probe member may simply be constituted by the distal end of the spring. Alternatively, the probe member may be distinct from the spring but
110 in contact with it.

The means for providing a warning signal may be contained within the main body portion of the housing.

Suitably, the means for providing a warning
115 signal is electrically operated and the housing member preferably therefore contains a source of electrical power such as one or more batteries for operating the means for providing a warning signal.

120 The warning signal may be audible or visible or tactile. Thus, when the container is empty or approaching emptiness, operation of the release valve may cause the device according to the invention to produce a noise, e.g. by the
125 operation of a chime or a buzzer. It may cause the operation of a light source such as a conventional light bulb, a light emitting diode (LED) or the change of state of a visible display such as a liquid crystal display (LCD) or
130 an electrochromic display (ECD). Alternatively,

it may produce a tactile warning such as releasing a spring loaded button to protrude from the housing where it can easily be felt. Such a tactile signal would be suitable for use by blind persons.

Where that part of the pressurised gas dispenser which is received in the housing is electrically conductive, e.g. is of metal, it is preferred that the housing, e.g. the main body portion of the housing, mounts at least one electrical contact positioned to contact said dispenser part upon sufficient movement of said housing over the dispenser part against the resilient bias of the probe member.

Preferably, an electrical circuit is formed between the probe member, said means for producing a warning signal, said source of electrical power and a said electrical contact, which is adapted to be completed by said dispenser part bridging between said contact and said probe member.

Alternatively, an electrical circuit may be formed between a first said contact, said means for producing a warning signal, said source of electrical power, and a second said electrical contact, which circuit is adapted to be completed by said dispenser part bridging between said first and second electrical contacts.

Preferably, the position of said electrical contacts is adjustable to set the operating pressure at which the device will provide a warning signal.

In one preferred embodiment, the device constitutes a pressurised inhaler alarm and comprises a round tube registering over the top of the gas canister in use, a compression spring supporting an inner housing with miniature batteries, contacts and a light emitting diode (LSD) adapted into an insulating pressure pad on top of the inner housing.

If desired, the device may be adapted to provide a signal, to confirm satisfactory operation rather than as a warning signal, when the release valve of a pressurised gas dispenser fitted with the device is operated when there is adequate contents in the dispenser. Similarly, if desired separate warning signals may be provided to indicate that the container is almost empty and finally that the container is empty.

The invention will be illustrated by the following description of preferred embodiments thereof, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a device according to the invention in position on an aerosol container in a dispensing apparatus;

Figure 2 is an axial cross-section through a first device according to the invention in position on an aerosol container and pressed down to operate the container's release valve when the container is full;

Figure 3 is a similar view to Figure 1 of the same device pressed down against the aerosol

sol container base so as to operate the release valve when the container is empty and hence to operate the warning signal;

Figure 4 is an enlargement of the circled portion of Figure 1;

Figure 5 is a perspective view of a second device according to the invention in position on an aerosol container in a dispensing apparatus which is partly shown;

Figure 6 is an axial cross-section through the embodiment of Figure 5 in a similar state to that shown in Figure 2;

Figure 7 is a similar view of the device of Figure 6 compressed against the base of the aerosol container in a similar state to that shown in Figure 3;

Figure 8 is an axial cross-section of exploded view of a third embodiment according to the invention; and

Figure 9 is a section on the line IX-IX of Figure 8.

As shown in Figure 1, an inhaler apparatus 12 consists of a tubular receptacle for receiving an aerosol container 2 in an inverted attitude. The inhaler apparatus 12 has an outlet nozzle 12a for medicament supplied from the aerosol container 2. In normal use, the aerosol container 2 would be depressed against a seating within the receptacle of the inhaler apparatus 12 to depress the body of the container with respect to the outlet nozzle of the release valve thereof.

A device according to the invention is shown positioned on the base of the container 2 as can more clearly be understood from Figure 2.

In Figure 2, the device according to the invention is seen to comprise a housing member consisting of an outer tube 1, an inner housing 4 which is a sliding fit within outer tube 1, and an insulating pressure pad 6 which has a portion which fits as a plug in the top of inner housing 4 and a larger diameter top portion. Inner housing 4 is formed as a hollow cylindrical cup such that pressure pad 6 closes the mouth thereof.

Outer tube 1 is a sliding fit over the base of the container 2.

An annular space is formed between the lower part of the inner housing 4, which is of reduced diameter, and the interior wall of the outer tube 1. In the annular space, there is retained a compression spring 3 anchored at one end 14 in the inner housing 4. The spring 3 bears against the base of the container 2.

Within the inner housing 4 are disposed two miniaturised electrical batteries B1 and B2 forming the power supply for the device. At the base of the inner container 4 an axially adjustable threaded elongate contact 5 protrudes through the base of the inner container 4 in screw engagement therewith to contact the lower face of the lower of the two batteries B2. A second electrical contact 9 passes through the pressure pad 6 to contact the

upper face of battery B1. The proximal end 14 of the spring 3 extends through a suitable bore in the inner housing 4 to make electrical contact with a contact band 7 on the plug portion of the pressure pad 6 and lead wires of an LED bridge between the contact band 7 and the contact 9.

The inner housing 4 is guided for limited axial movement within the outer tube 1 by locating pins 11 and 13.

When the container 2 is well charged with contents, light pressure on the pressure pad 6 will cause downward displacement of the inner housing 4 within the outer tube 1 and/or of the outer tube 1 over the base of the container 2. The distal end of the spring 3 will act as a probe member to communicate the downward force to the base of the container 2 causing the container body to be driven downwards with respect to the actuator member of the release valve of the aerosol dispenser, thus providing a dose of medicament through the outlet 12a. It is in this depressed condition that the device is illustrated in Figure 2. The contact 5 remains clear of the base of the container.

When the container is almost or completely empty, greater force will be required to operate the release valve and the spring 3 will therefore be more compressed. Thus, the base of the container 2 touches the contact 5 completing an electrical circuit indicated by the dotted line and causing the red LED to light whilst the operator's thumb is holding down the pressure pad 6.

In the alternative embodiment illustrated in Figures 5 to 7, the outer tube 1 and the inner housing 4 are replaced by a main housing portion 20 bearing an integral, depending, circular, tube-like skirt 21. As before, an annular space is provided within the skirt 21 around a reduced diameter portion 22 of the main housing body 20. The main housing body 20 is hollow having an upwardly open hollow structure containing two miniaturised batteries B1 and B2. Once again, a contact 5 is provided passing through the bottom of the main housing portion to contact one face of the battery B2. The main housing portion 20 has an upstanding rim 23 for receiving an insulating pressure pad 6 containing, as before a central electrical contact 9 making contact with the upper face of battery B1. A LED 8 is in electrical contact with the contact 9 and the proximal portion of spring 3.

As seen in Figure 5, guide fingers 24 extend from the skirt 21 to continue over the surface of the container within the receptacle 12 of the inhaler apparatus. The device is shown in Figure 6 depressed against the base of a container 2 which is adequately charged with contents. The container 2 is depressed down against the actuator member of its release valve to open the release valve by the force transmitted through the spring 3 as the

housing skirt 21 is pressed down over the container 2. The contact 5 does not touch the base of the container because the opening force required to be transmitted through spring 3 does not produce sufficient compression of the spring.

Figure 7 shows the situation when the container 2 is empty or substantially empty.

Greater force is then required to be transmitted through the spring 3 and the contact 5 touches the base of the container to establish an electrical circuit to light LED 8.

A third embodiment shown in Figure 8 is generally similar to that shown in Figures 5 to 7 except that rather than utilising the spring 3 as part of the electrical circuit, two axially adjustable contacts 5a and 5b are provided protruding from the base of the main body portion of the housing, each making contact at its upper end with one face of a respective battery B1, B2 arranged for connection in series. The pressure pad 6 once again contains an LED 8, connections being provided between the LED 8 and the two batteries B1, B2. Accordingly, in this device the circuit which is established upon sufficient compression of the spring 3 is between the two contacts 5a and 5b bridged by the base of the container.

Although the invention has been described with reference to specific characteristics of the illustrated embodiments, many variations and modifications thereof are possible within the scope of the invention. Instead of an LED to provide the signal, this may be provided in any of the ways described above. A further indicator may be provided to provide a signal indicating that an aerosol container contains an adequate amount of contents. Instead or in addition, a further indicator may be provided to provide a signal when the container is becoming empty but is not yet substantially empty.

Alternatively, separate indicators may be provided to provide signals when the device is used in conjunction with a container which is adequately full, substantially empty and entirely empty respectively.

CLAIMS

1. A warning device for use in conjunction with a pressurised gas dispenser of the kind having a container having a release valve operated by movement of an actuator member relative to the container against restoring force, which device is adapted to warn of emptying of the container and comprises a housing member, a probe member mounted in the housing member for acting against said container or said actuator member in use, whereby movement of the housing member may be transmitted via said probe member to operate said release valve by effecting relative movement between said container and said actuator member in use, means for detecting when force applied by said probe member to

said container or actuator member reaches a predetermined value, and means for providing a warning signal upon said force reaching said predetermined value.

- 5 2. A device as claimed in Claim 1, comprising said housing, said probe member, which is displaceable for movement towards said housing member, means for producing resilient bias against said displacement which resilient bias increases with displacement, means for detecting when movement of said probe member toward the housing member against said resilient bias reaches a predetermined extent and means for providing a warning signal upon said movement toward the housing member reaching said predetermined extent.
- 10 3. A device as claimed in Claim 1 or Claim 2, wherein the housing member has a mouth portion adapted to fit over the base of a container of an aerosol dispenser.
- 15 4. A device as claimed in Claim 1 or Claim 2, wherein the housing member has a mouth portion adapted to fit over an actuator member of the release valve of a pressurised gas dispenser.
- 20 5. A device as claimed in Claim 3 or Claim 4, wherein the mouth portion is defined by a skirt depending from a main body portion of the housing member.
- 25 6. A device as claimed in Claim 5, wherein said probe is provided at the distal end of a spring lying within said skirt and serving to provide said resilient bias.
- 30 7. A device as claimed in Claim 5, wherein the probe member is constituted by the distal end of the spring.
- 35 8. A device as claimed in any preceding claim, wherein the means for providing a warning signal is electrically operated and the housing member contains a source of electrical power for operating the means for providing a warning signal.
- 40 9. A device as claimed in Claim 8, wherein an electrical circuit is formed in use between the probe member, said means for producing a warning signal, said source of electrical power and an electrical contact, which is adapted to be completed by a container part bridging between said contact and said probe member.
- 45 10. A device as claimed in Claim 8, wherein an electrical circuit is formed in use between a first said contact, said means for producing a warning signal, said source of electrical power, and a second said electrical contact, which circuit is adapted to be completed by a container part bridging between said first and second electrical contacts.
- 50 11. A device as claimed in Claim 9 or Claim 10, wherein the position of said electrical contact or contacts is adjustable to set the operating pressure at which the device will provide a warning signal.
- 55 12. A warning device for use with a pressurised aerosol dispenser substantially as
- 60
- 65

hereinbefore described with reference to Figures 1 to 4, 5 to 7 or 8 and 9 of the accompanying drawings.

- 70 13. A pressurised aerosol inhaler comprising a receptacle, a pressurised gas cannister loaded into the receptacle leaving a base portion thereof protruding to be pressed by a user and a warning device as claimed in any preceding claim with said housing member received over the base of the cannister so that
- 75 said probe member acts against the cannister base.

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